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New Species of Fungi.

By Chas. H. Peck.

Amanitopsis velosa.

Pileus at first subglobose, then campanulate or nearly plane, generally bearing patches of the remains of the whitish felty or tomentose volva, elsewhere glabrous, becoming sulcate-striate on the margin, buff or orange-buff, flesh compact, white; lamellae close, reaching the stem, subventricose, pale cream color; stem firm, at first tomentose and attenuated at the top, then nearly equal, stuffed, white or whitish, closely sheathed at the base by the thick volva; spores globose, .0004 to .0005 in. broad.

Pileus 2 to 4 in. broad; stem 3 to 4 in. long, 3 to 4 lines thick.

Under oak trees. Pasadena, California. April. A. J. McClatchie.

This fungus is closely related to *Amanitopsis vaginata*, from which it may be separated by the more adherent remains of the thicker volva which sometimes cover the whole surface of the pileus, and by the thicker lamellae which are somewhat adnate to the stem and terminate with a decurrent tooth.

Tricholoma semivestitum.

Pileus thin, expanded, centrally depressed or subumbilicate, glabrous, blackish-brown, the margin decurved or involute; lamellae close, emarginate, often dentate or eroded on the edge, whitish tinged with blue; stem short, solid, usually slightly thickened at the base, the lower part clothed with a tawny-brown tomentum, the upper part brown; spores broadly elliptical or subglobose, uninucleate, .00016 to .0002 in. long, .00016 broad.

Pileus 6 to 12 lines broad; stem 8 to 12 lines long, 2 to 3 lines thick.

"On old grass roots in sandy prairie pasture," Rooks County, Kansas. July. E. Bartholomew.

The small size, dark-brown pileus and semitomentose stem are the prominent characters in this species.

• COLLYBIA MICROSPORA.

Pileus thin, convex, subumbonate, glabrous, white; lamellae broad, subdistant, nearly plane, white, changing to brown in drying; stem slender, hollow, glabrous, white, becoming brown in drying; spores minute, broadly elliptical, .00016 in. long, .00012 broad.

Pileus about 6 lines broad; stem about 1 in. long, 1 line thick.

Wet ground under bushes. Rooks county, Kansas. July. Bartholomew.

This plant, in the dried state, might easily be taken for some species of *Naucoria*, since the lamellae assume a rusty-brown hue. This change of color in the lamellae and stem is a peculiar feature of this small species which the notes of the collector record as "pure white throughout."

• MYCENA CAESIA.

Pileus submembranous, campanulate, striate, glabrous, grayish-brown, blackish or blackish-brown in the center; lamellae thin, subventricose, grayish or bluish-gray; stem slender, hollow, glabrous, grayish-brown; spores subelliptical, slightly apiculate at one end, .0003 to .0004 in. long, .00016 to .0002 broad.

Pileus 4 to 6 lines broad; stem 1 to 2 in. long, .5 to 1 line thick.

Among sphagnum. Newfoundland. September. Rev. A. C. Waghorne.

I have seen dried specimens only and am not certain that the bluish-gray hue of the lamellae is so conspicuously present in the fresh plant. The margin of the pileus is sometimes tinged with yellowish-brown.

• HYGROPHORUS SPHAEROSPORUS.

Pileus fleshy and thick in the center, subobconic, convex, obtuse or slightly umbonate, whitish, inclining to reddish-brown, the margin incurved, flesh firm, white; lamellae rather broad, subdistant, adnate or slightly decurrent, white; stems tufted, flexuous,

solid, glabrous, often slightly thickened at the base, colored like the pileus; spores globose, .00024 to .0003 in. broad.

Pileus 6 to 12 lines broad; stem 1 to 2 in. long, 2 to 3 lines thick.

Iowa. October. Communicated by C. McIlvaine.

The fresh plant is said to have no decided odor, but when partly dried it emits a slight but rather unpleasant odor. It belongs apparently to the Section Camarophyllus, and is related to *Hygrophorus Peckii.*

MARASMIUS SUBTOMENTOSUS.

Pileus thin, at first subcampanulate, then convex or nearly plane, even or slightly striate on the margin, minutely tomentose-pubescent, grayish or reddish gray; lamellae broad, subdistant, free or but slightly adnexed, ventricose, colored like the pileus; stem equal or slightly swollen toward the base, inserted, velvety-tomentose, grayish or grayish-brown, white within; spores .0004 to .0005 in. long, .0002 to .00025 broad.

Pileus 5 to 9 lines broad; stem about 1 in. long, 1 line thick.

Abundant on roots of grasses and other plants in sandy soil. Kansas. July. Bartholomew.

The minute tomentum of both pileus and stem which gives them a grayish hue, the inserted stem and the free subdistant lamellae mark the species.

MARASMIUS BADIUS.

Pileus thin, convex, even, glabrous, bay-brown or reddish-brown; lamellae narrow, subdistant, adnate, whitish; stem glabrous, hollow, blackish-brown; spores broadly elliptical, .0002 in. long, .00012 broad.

Pileus 3 to 6 lines broad; stem about 1 in. long, 1 line thick.

Decaying sticks lying on wet ground. Kansas. July. Bartholomew.

In the dried specimens the stem is of a darker hue than the pileus. This gives a peculiar appearance to the plant and makes the species easily recognizable.

VOLVARIA STRIATULA.

Pileus thin, convex or nearly plane, minutely silky, striate on the margin and somewhat reticulate when dry, white; lamellae

narrow, free, white, becoming flesh color; stem short, glabrous, white, with the cup-like remains of the membranous volva at the base; spores subglobose, uninucleate, .0003 in. long, nearly as broad.

Pileus 6 to 9 lines broad; stem about 1 in. long, .5 to 1 line thick.

Wet ground under weeds. Kansas. July. Bartholomew.

This species is allied to *V. parvula*, from which it is separated by the striate margin of the pileus and the larger and nearly globose spores. In the dried specimens there are transverse ridges or wrinkles between the marginal striations which give a reticulate appearance.

PLUTEUS STERCORARIUS.

Pileus very thin, nearly plane, glabrous, pure white: lamellae rather broad, close, free, flesh color; stem equal, solid, glabrous, white; spores large, even, commonly uninucleate, .0005 to .0006 in. long, .0003 broad.

Pileus about 2.5 in. broad; stem 3 in. long, 3 lines thick.

Manure heaps. Kansas, July. Bartholomew.

The habitat of this species is peculiar. Most of the species of this genus grow on decaying wood and have smaller spores.

INOCYBE RADIATA.

Pileus thin, convex or subcampanulate, distinctly umbonate, silky-fibrillose, slightly rimulose, distantly radiately wrinkled when dry, yellowish-brown, the umbo commonly blackish-brown; lamellae rather broad, close, emarginate, brownish becoming tawny-cinnamon when old, whitish on the edge; stem equal, solid, subglabrous, a little paler than the pileus; spores subovate, slightly nodose or angular, .0004 to .0005 in. long, .0002 to .00025 broad.

Pileus about 1 in. broad; stem 1 to 2 in. long, 1 to 2 lines thick.

In open grassy ground. Massachusetts. Aug. and Sept. W. D. Jackson.

The species belongs to the Rimosae. In general appearance it is similar to *I. fuscodisca*, *I. infida* and *I. agglutinata*, but the radiating ridges of the dried pileus and especially the peculiar spores easily separate it from any of these. Its spores are somewhat variable. Some are nearly even, others have one or two nodes, and many of them are irregular or angular like the spores

of species of *Entoloma*. Some are nearly elliptical in outline, but generally they are narrowed toward one end. They are mostly one or two-nucleate. The radiations of the pileus are not noticeable in the fresh plant.

FLAMMULA DECURRENS.

Pileus thin, umbilicate centrally depressed or funnelform, moist, minutely floccose-squamulose, pale yellow or cream color; lamellae subdistant, strongly decurrent, pale yellow becoming ochraceous, the interspaces sometimes veiny; stem equal or tapering downward, minutely downy, stuffed with a cottony pith, colored like the pileus; spores elliptical, .0003 to .00035 in. long, .00016 broad.

Pileus about 1 in. broad; stem 6 to 10 lines long, 1 to 2 thick.

Wet ground in shade of bushes. Kansas. July. Bartholomew.

The species is easily known by its color being a uniform rich creamy or sulphury hue in the fresh plant, and by its strongly decurrent lamellae which become ochraceous-yellow in the dried state.

CREPIDOTUS CINNABARINUS.

Pileus thin, sessile, resupinate or reflexed, minutely tomentose or pulverulent, cinnabar-red; lamellae rather broad, subdistant, minutely reddish-flocculent on the edge, brownish-tawny in the dried plant; spores broadly elliptical, .0003 in. long, .00024 to .00028 broad.

Pileus 3 to 4 lines broad.

Decaying wood. Michigan. Sept. L. N. Johnson.

STROPHARIA CÆSIFOLIA.

Pileus convex, glabrous, white or whitish, sometimes brownish in the center; lamellae close, rounded or emarginate behind, light blue, becoming dingy bluish-brown; stem equal or slightly thickened at the base, solid, glabrous, white or whitish, the annulus white; spores subelliptical, .0004 to .0005 in. long, .00024 to .0003 broad.

Pileus 1 to 2 in. broad; stem 1 to 1.5 long, 2 to 3 lines thick.

Low sandy pastures. Kansas. July. Bartholomew.

The collector of this plant remarks that it is much like the common mushroom, *Agaricus campester*, except that its lamellæ have a fine light blue color instead of pink. This is an unusual

and very distinctive character. In the dried specimens the lamellae have assumed a dingy grayish-blue hue, inclining to brown.

HYPHOLOMA CUTIFRACTA

Pileus thin, campanulate or expanded, sometimes faintly striate on the margin, grayish-buff, the disk sometimes darker, the cuticle commonly irregularly rimose; lamellae thin, close, adnate, at first white or whitish, then rosy-brown; stem long, slender, hollow, glabrous, white; spores elliptical, brown, .0003 in. long, .0002 broad.

Pileus 1 to 2 in. broad; stem 3 to 4 in. long, 1 to 2 lines thick.

About stumps of Lombardy poplar. Kansas. July. Bartholomew.

This species is closely related to *H. incertum*, but differs in its long slender stem and in its cuticle cracking in an irregular manner and revealing the thin white flesh beneath. No remains of the veil are visible in the dried specimens. Sometimes the margin of the pileus is deeply split.

PSATHYRELLA LEUCOSTIGMA.

Pileus submembranous, campanulate, striate, bluish-white when fresh, changing to sepia-brown when dried, the apex remaining whitish; lamellae close, lead color when young, becoming black with age, whitish on the edge; stem slender, flexuous, hollow, white; spores black, elliptical, .0005 to .0006 in. long, .0003 broad.

Pileus 4 to 6 lines broad; stem 1 to 1.5 in. long, about 1 line thick.

Wet ground under trees. Kansas. July. Bartholomew.

This pretty little species is well marked in the dried state by the white apical spot on the pileus. The plant is probably hygrophanous in the fresh state.

PSATHYRELLA BARTHOLOMAEI.

Pileus thin, subconical or convex, glabrous, striate on the margin, pale brown; lamellae close, nearly plane, adnate, brownish becoming black; stem slender, flexuous, hollow, adorned with a few grayish fibrils, pale brown; spores elliptical, .0004 to .0005 in. long, .0002 to .00025 broad.

Pileus 6 to 12 lines broad; stem 1 to 1.5 in. long, scarcely 1 line thick.

"Rich ground in shade of trees." Kansas. July. Bartholomew.

COPRINUS EBULBOSUS.

Pileus thin, campanulate, variegated by the cuticle breaking into broad superficial persistent whitish scales, the surface beneath the cuticle somewhat striate, grayish-brown, the margin at length revolute, lacerated; lamellae narrow, thin, crowded, free, slate color becoming black; stem equal, hollow, white; spores elliptical, .0003 to .0004 in. long, .0002 broad.

Pileus 2 to 3 in. broad; stem 3 to 6 in. long, 2 to 3 lines thick.

Caespitose at the base of cottonwood stumps. Kansas. July. Bartholomew.

This plant resembles *C. picaceous* very closely. New York specimens were formerly referred to it as variety *ebulbosus*, but having now received it from various widely separated localities and finding that it maintains its distinctive characters with constancy, it seems best to consider it a good species. Its peculiar characters are the absence of a bulbous base to the stem and its smaller spores. It also sometimes grows in large tufts. "About fifty grew in a solid clump, all united at the base."

COPRINUS LANIGER.

Pileus thin, conical or campanulate, covered when young with numerous tawny tomentose or floccose scales which partly or wholly disappear with age, sulcate-striate nearly to the apex, pallid, tawny or grayish-ochraceous; lamellae crowded, at first whitish, then brownish-black; stem slightly thickened at the base, minutely downy or pruinose, hollow, white; spores oblong-elliptical, commonly uninucleate, .0003 to .0004 in. long, .00016 broad.

Pileus 6 to 12 lines broad; stem about 1 in. long, 1 to 2 lines thick.

Caespitose at the base of cottonwood stumps. Kansas. July. Bartholomew.

The species resembles *C. micaceus*, from which it is distinguishable by the floccose-squamose coating of the young pileus and by its more narrow spores. Mr. Bartholomew remarks that "it is of slow growth, taking three or four days for development."

THELEPHORA SUBUNDULATA.

Pileus thin, subcoriaceous, centrally depressed, plicate-undulate on the margin, subcinereous or grayish-brown; hymenium slightly uneven, paler than the pileus, grayish or grayish-yellow; stem firm, solid, rarely branched, colored like the pileus; spores broadly elliptical, .0003 in. long, .0002 broad.

Pileus about 6 lines broad; stem 8 to 10 lines long, scarcely 1 line thick.

Ground. Delaware. July. A. Commons.

This species appears to be related to, but much smaller than *T. undulata*. It differs from it in having a glabrous hymenium and larger spores. The stem is not polished, but to the naked eye appears to be priunose-pubescent. Sometimes the margin of the pileus is more than wavy, its folds overlapping.

SECOTIUM DECIPIENS.

Peridium subglobose or depressed globose, its surface rupturing into rather broad, loose or appressed scales, cream-colored, the inferior part at first closely pressed to the stem and sometimes separating from the upper part and forming a kind of annulus, sometimes splitting longitudinally and gradually falling away, leaving the upper part in the form of a pileus; the glebe lamelliform, but variously united and anastomosing, forming irregular and somewhat labyrinthiform cells, free from the percurrent stem, almost or quite black; stem stout, commonly tapering upward, abruptly narrowed as it enters the peridium, firm, solid, externally colored like the peridium, internally tinged with yellow or rhubarb color; spores globose or subglobose, even, black or brownish-black, .0002 to .00028 in. long.

Peridium 1 to 4 in. broad; stem 3 to 6 in. long, 1 in. or more thick at the base, 5 to 10 lines where it enters the peridium.

Streets and lawns. Pasadena, California. April. McClatchie.

The copious blackish spores are an unusual feature in the genus Secotium. The lamelliform septa sometimes rupture in such a way as to form coarse aculeiform processes as in the genus Polyplocium, and thus the plant might easily be referred to that genus. But I find no filamentous capillitium in the specimens before me, and no evidence of a volva, and have therefore referred them to the genus *Secotium*, between which and *Polyplocium* this species forms a connecting link.

Macrosporium Amaranthi.

Hyphae short, .0008 to .0012 in. long, septate, slightly nodose at the top, forming minute punctiform blackish tufts; spores clavate oblong-clavate or subfusiform, 3- to 8-septate, one to three of the cells with longitudinal septa, .0012 to .0024 in. long, exclusive of the slender pedicel which is commonly shorter than the spore.

Dead spots of leaves of *Amaranthus retroflexus*. Kansas. August. Bartholomew.

The fungus appears to the naked eye to form brownish patches on the spots.

Macrosporium Clematidis.

Spots small, 2 to 3 lines broad, suborbicular, whitish, gray or brownish, often with a more or less distinct brown border; hyphae amphigenous, caespitose or thinly effused, colored, septate, flexuous, .002 to .004 in. long, .00025 to .0003 broad; spores obovate or subclavate, 3- to 4-septate, commonly constricted at the septa, .001 to .0016 in. long, .0005 broad, the pedicel nearly as long as the spore.

Living or languishing leaves of *Clematis Fremonti*. Kansas. September. Bartholomew.

Heydenia fungicola.

Plant scarcely half a line high, black; receptacle at first elliptical, becoming hemispherical truncate or disciform above and dusted with the spores, about .007 in. broad; stem subcylindrical; spores catenulate, globose or subglobose, colored, .00016 to 0002 in. long.

On old specimens of *Polyporus abietinus* green with incrusting algæ. Maine. Sept. F. L. Harvey.

This was found associated with *Calicium tigillare* which it closely resembles.

Some special phylogenetic Adaptations in Lichens.—I.

By Albert Schneider.

In a previous paper* I endeavored to show why lichens should be considered as a distinct class of plants. It is my purpose in this paper to discuss briefly some of the special adaptive features which these plants have acquired since their phylogeny as lichens. I shall preface this discussion with a few introductory statements.

Everywhere we can observe a balanced relationship between living organisms and their environment. All structures, no matter where they may occur, or what form they may assume, serve a definite purpose and perform a definite function. In many instances the structural conformations are so "rudimentary" and "imperfect" that we are unable to recognize their physiological significance. It is however unscientific to say that such structures perform no function, because we are unable to recognize a function. It were much more consistent to admit our ignorance and await further investigations, which may clear up some of the difficulties. I make these preliminary statements with special reference to lichens, because many of their structural adaptations have as yet not been satisfactorily explained. I also wish to call attention to the importance and special biologic significance of the tendency among modern scientific botanists to point out the interrelation of structure and function. There is no function without structure: without structure there could be no function.

From this it becomes evident that morphological and physiological investigations must go hand in hand. If we neglect one for the other we fall into a dangerous error, dangerous to the progress of biological science. The time is fortunately slowly passing away when morphology (usually external morphology) alone constitutes the science of life. The herbalists who go into wild ecstacies over having "discovered" a "new species" are slowly giving way to the scientists who are solving or endeavoring to solve some difficult life-problem. The fact that many scientific efforts are fruitless in direct results is not a reason for becoming

* The Biological Status of Lichens. Bulletin, 22: 189–198. 1895.

discouraged; much less a reason why old fashioned "empiricists" should gloat over these failures and make strenuous efforts to perpetuate the old regime.

The knowledge gained from a purely morphological study of lichens, is in itself of little practical value if we can not find the correlated physiological interpretation. The scientific study of lichens is of very recent origin. Our knowledge of the physiology of these plants is especially deficient. Sufficient is, however, known in a general way, to enable us to give fairly accurate hypothetical physiological interpretations of most of the anatomical structures.

It is perfectly consistent to suppose that the lichen, during phylogenetic history, has undergone great adaptive changes. This statement is axiomatic and requires no further elucidation. From the nature of things it is also evident that the thallus has undergone the greatest adaptive changes.

As has been known for some time, the thallus in particular performs the function of assimilation, due to the presence of the symbiotic algae. Within recent years, Jumelle* has made a special study of chlorophyllian assimilation in lichens. The special structural adaptations which we are about to discuss are due to the fact that the fungal symbiont, which is incapable of assimilating CO_2, must make suitable concessions to the position and arrangement to the algal symbiont. This we find to be the case. In this paper I shall devote myself to foliaceous thalli and shall briefly consider some of the typical structures met with in such thalli; namely, the epidermal layer, the upper cortical layer, the algal ("gonidial") layer, the medullary layer, the lower cortical layer and the rhizoids. A typical epidermal layer is not present in all foliaceous lichens. It is, however, well developed in *Sticta* and *Stictina*. It consists of hyphal cells, two or three layers in thickness. The cells are placed horizontally and are very closely crowded, thus forming a protection against excessive evaporation. It serves a function similar to the epidermis in higher plants. In the genus *Leptogium* the epidermis consists of a single layer of cells presenting a close resem-

*Jumalle H. Recherches Physiologiques sur les Lichens. Revue generale de Botanique, 4: 49–64, 103–121, 159–175, 220–231, 259–272, 305–320. 1892.

blance to the cuticle of higher plants. We find a similar cuticular covering in the related genera, *Mallotium*, *Hydrothyria* and *Polychidium*. This structure not only serves the function of an epidermal layer, that is, prevents excessive evaporation, but also a mechanical function, giving greater firmness to the thallus. In other words, the single layer of cells in the above genera of the Collemaceae serves a function similar to the many-layered epidermis and cortical structure in *Sticta*, *Stictina* and other genera.

The epidermal layer is generally colored, usually a yellowish brown or dark brown. This is no doubt for the purpose of tempering the influence of sunlight. We may safely assume that the epidermal layer serves three functions. Its primary function is to prevent the excessive evaporation of moisture; its secondary functions are to reduce the injurious effect that direct isolation would have upon the symbiotic algae and to aid in protecting the underlying tissues as well as to give additional firmness to the thallus.* Below the epidermis is found the cortical layer, which is usually of considerable thickness in the majority of foliaceous lichens. I will not dwell upon its anatomical structure, as that is sufficiently well known. Its primary function is mechanical. It also serves a function similar to that of the epidermis; it prevents the evaporation of moisture.

According to the principles of mechanics and for the purpose of protection the cortical layer should occur near the upper surface of the thallus. But for physiological reasons the algal layer should also be near the upper surface, that the algae may be acted upon by the sunlight and that they may more readily come in contact with the CO_2 of the atmosphere and that they may readily give up the O which is liberated as the result of assimilation. We actually find such an adaptive relationship between the algal layer and the cortical layer. In many of the foliaceous lichens we find that the algae extend almost to the upper surface of certain circumscribed areas; that is the cortical layer is not of uniform thickness. Such an arrangement enables the algae to take up CO_2 from the atmosphere in exchange for the O

* It should be borne in mind that there is no living structure whose function is purely mechanical or purely physiological. "Dead" structures *may* have only a mechanical function.

liberated. This could, however, not take place, if the epidermis and the upper and lower cortical layers were unbroken or without intercellular spaces. I shall now discuss some of the structural adaptations to meet this requirement.

On the closer examination of a thin vertical section of the thallus, it is found that in many of the foliaceous lichens numerous *intercellular* canals (intercellular spaces) pass from the algal layer through the cortical and epidermal layers. These canals, which resemble the stomata in their physiological function, facilitate the interchange of the gases resulting from the activities of chlorophyllian assimilation. The canals (breathing pores) are much branched and occur most frequently in the thin areas of the upper cortical layer. As a rule, they do not pass to the exterior in a vertical direction. In the epidermal layer they take almost a horizontal course; this is because the cells of the epidermis are elongated horizontally.

In the dry state these canals are practically closed, thus reducing the loss of moisture to a minimum. In the moist state they enlarge considerably, thus enabling assimilation, which is dependent upon the presence of CO_2 and sunlight, to take place. These breathing pores are especially numerous in *Nephromium*, *Solorina* and *Parmelia*.

Other lichen genera do not have the breathing pores just mentioned. For example they are not noticable in the genera *Sticta* and *Stictina*. In these two genera the epidermal layer is distinct, as has been stated. The upper cortical layer is of uniform thickness and consists of very compact, rather small hyphal cells. The lower cortical layer is comparatively thin and its cells are less closely united; yet they are sufficiently compact that no intercellular spaces can be detected. The question now arises, how are the enclosed algae * supplied with the necessary atmosphere? In my opinion this is done by means of the so-called *cyphellae* which occur on the lower surface of the thallus. These structures have long been known to lichenologists. Haller (1776) was perhaps the first author who called special attention to them. He de-

* I have purposely substituted the term "algae" for the term "gonidia." Gonidia and related terms as "gonimia," "gonidimia," etc., are meaningless in modern lichenology, and should therefore be rejected.

scribed them as "white circular depressions." This was about all that was known concerning these structures at that time. Acharius was the first to introduce the term cyphellae, which term has been retained up to the present. Since these organs are little known, it will be well to describe them more in detail.

The cyphellae occur almost exclusively in the genera *Sticta* and *Stictina* and are primarily breaks in the continuity of the lower cortical layer. The hyphae of the medullary layer immediately about the opening in the cortical layer divide more frequently, producing a dense net-work of hyphae or even a semicortical structure. As a rule, the cells of this secondary cyphellar formation extend in a direction at right angles to the outer surface; that is, they assume a suitable position for the conduction of food-substances. The margin of the primary cortical layer (the cortical layer of the thallus) is turned more or less outward. As a rule the algae of the algal layer immediately over the cyphellar opening multiply more rapidly, this causing them to accumulate at these areas.

Two kinds of cyphellae may be recognized. Form 1, as seen in *Stictina damaecornis*. The cyphellar depression is usually circular, concave inward, the margin of the cortex forming an outer constriction. The broken-down cortex of the thallus is replaced by the secondary semicortical formation of the medullary hyphae. Its outer surface is usually smooth, devoid of rhizoids, and generally of a paler color than the primary cortical tissue. They are irregularly distributed over the elevated portions of the lower surface of the thallus; none ever occur in the grooves. They appear first in the older portions of the thallus. In form they are quite constant, in size they decrease toward the younger portion of the thallus.

Form 2, as seen in the majority of *Stictas* and *Stictinas*. It is much more common and differs from the former in the absence of the formation of a secondary semicortical cyphellar covering. Instead of a depression as in the former case, there is usually a protrusion of the densely interwoven network of medullary hyphae. Their form is usually less regular. Their position and arrangement is the same as in the first form.

Both forms of cyphellae are sufficiently large to be seen by

the naked eye. No cyphellae occur near the actively growing tip of the thallus.

Acharius applied the term cyphellae to the form first described. Those of the second form he considered to be soredia. Nylander retained the name cyphellae for the first form. The second form he designated as *psuedocyphellae*. There is no morphological or physiological reason why the latter should be designated as "false." Indeed it were more consistent to designate the first form as false since they are of less frequent occurrence. Stitzenberger* retains Nylander's distinction into true and false cyphellae and further subdivides them as to color into white and yellow. This subdivision seems to be valueless, since their color depends upon the color of the medullary hyphae. Stitzenberger considers them of special importance in his classification of the Stictei. I am, however, opposed to adopting as primary, morphological characters whose physiology is unexplained.

Having thus briefly treated of the morphology of cyphellae we will now refer to their probable physiological significance. As already stated, they very likely serve to admit air into the interior of the thallus. Some of the older lichenologists looked upon them as vegetative propagative organs, similar to the soredia. They are not soredia, since they usually contain no algae. That the second form may accidentally contain algae is possible, since we find occasional algae throughout the medullary layer. It is, however, unreasonable to suppose that they would normally contain algae, since their position is not suitable for the development of the symbiotic algae. From the nature of the cortical layers and the epidermis in the majority of Stictei, it is reasonable to assume that the cyphellae serve a function similar to that of the stomata of ordinary foliage leaves. That is, the cyphellae and breathing pores of lichens are functionally similar. If it is scientific to make any comparison of the morphology of lichens and phanerogams it may be stated that the cyphellae are analogous to lenticels.* The tissue which closes the opening in the lower cortical layer is the result of a special cambial or meristematic activity.

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*Stitzenberger, E. Die Gruebchenflechten (Stictei) und ihre geographische Verbreitung. Flora, 81: 88–150. 1895.

*This analogy was pointed out by Dr. Smith Ely Jelliffe at a recent meeting of the Torrey Botanical Club (November 5th).

There is still another adaptive structural feature in the thallus of many lichens, especially in the Stictei, which is of undoubted physiological importance. These lichens present a striking appearance by the numerous ridges and depressions on the upper surface of the thallus. Morphologically and physiologically the ridges are analagous to the vascular system in the true foliage leaves. On microscopic examination it is found that the majority of the medullary hyphae of the ridges extend parallel to the direction of the ridges. In this region the medullary layer is also considerably thickened. It is a structure specialized to conduct the products of assimilation. This wavy outline of the thallus also increases surface expansion, whereby assimilation is increased. Assimilation is most active in the depressed portions of the thallus, which also corresponds to the position of the cyphellae on the lower surface. Such a wavy arrangement of structures also serves a mechanical function; according to the principles of mechanics it affords a better support to the frequently very large thallus.

A Study of the Genus Galactia in North America.

By Anna Murray Vail.

The genus *Galactia* was established by Patrick Browne in Nat. Hist. Jamaica, 298. *pl. 32. f. 2.* 1756. It was based on the plant figured in the illustration, a species with the stamens of *Galactia* and the showy scarlet flowers of *Collaea*, which forms a connecting link between these two sections. Linnæus reduced the genus to *Clitoria*, describing the Jamaica plant under the name of *Clitoria Galactia.** Michaux in Fl. Bor. Am. 2: 61, revived the genus, with two North American species.

The following genera have been reduced to *Galactia:*

Odonia Bertol. Lucub. Herb. 35. 1822.

Swcetia DC. Mem. Leg. 358. 1823.

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* The synonymy of this species is as follows:

Galactia Galactia (L.).

Clitoria Galactia L. Sp. Pl. Ed. 2, 1026. 1763.

Galactia pendula Pers. Syn. 2: 302. 1807.

Illust. Lindl. Bot. Reg. *pl. 269.* 1818.

Collaea DC. Ann. Sci. Nat. (I.) 4: 96. 1825.
Betencourtia St. Hil. Voy. 1: 376. 1833.
Leucodictyon Dalz. in Hook. Kew Journ. Bot. 2: 264. 1850.
Heterocarpaea Scheele, Linnaea, 21: 467. 1850.

The genus is accepted as described by Taubert in Engler and Prantl, Nat. Pflantzenf. 3: part 3, 369, 1894, where some fifty species are credited to the temperate and tropical regions of both hemispheres.

Stems erect, decumbent or prostrate, *not twining*.
Leaves simple; flowers 1–2, sub-sessile in the axils of the leaves.
1. *G. heterophylla.*
Leaves 3-foliolate, sometimes simple; flowers 1-several in short-peduncled or subsessile, axillary racemes or fascicles. 2. *G. erecta.*
Leaves pinnately 3-foliolate or digitately 5-foliolate, with the terminal leafle petioled; flowers 1–4, peduncled. 3. *G. Grayi.*
Leaves 3-foliolate.
Stems erect, branched; leaflets oblong-linear; flowers few, approximated near the top of the rhachis. 4. *G. brachypoda.*
Stems prostrate; leaflets oval or oblong-oval; flowers numerous, showy, scattered often the whole length of the rhachis, or in var. *longeracemosa* mostly near the top. 5. *G. Floridana.*
Stems *twining*, prostrate or climbing on bushes.
Leaflets 3.
Racemes 2–7, usually fascicled, in the axils of the leaves.
Racemes many-flowered, single or branched, as long as or longer than the short-petioled leaves; leaflets round-oblong or sub-orbicular, densely canescent. 6. *G. fasciculata.*
Racemes simple, 5–18 cm. long, flexuous and twisted; leaves long-petioled; leaflets oblong or oblong-orbicular, canescent.
7. *G. canescens.*
Racemes solitary or with a smaller, or rarely with 2 accessory ones.
Racemes as long as the leaves, few-flowered, or the upper flowers solitary in the axils; leaflets broad, oval, thinnish. 8. *G. Texana.*
Racemes as long as or somewhat longer than the leaves; leaflets glabrate or nearly so; leaves and rigid racemes erect on the prostrate or climbing stem. 9. *G. regularis.*
Racemes usually much exceeding the leaves or in some forms of *G. volubilis* shorter than the leaves.
Leaflets ovate-oblong, more or less pilose on both surfaces, rarely nearly glabrate; in var. *intermedia* linear or linear-oblong.
10. *G. volubilis.*
Leaflets oval, villous; peduncles stout, hirsute, much elongated: flowers bright rose-purple. 11. *G. mollis.*
Leaflets ovate-oblong, coriaceous, bright yellow-green; legume hirsute, the broad suture glabrous at maturity. 12. *G. Cubensis.*

Leaflets oblong-linear, more or less silvery canescent.
13. *G. Wrightii.*

Leaflets 7–9, elliptical-oblong; flowers white, tinged with red.
14. *G. Elliottii.*

1. **Galactia heterophylla** (Gillies).

Procumbent from a ligneous somewhat fusiform creeping rhizome; stems sub-simple, flexuous, 1–3 dm. long, minutely retrorse-hirsute, becoming glabrous, obscurely angled above; stipules 2–3 mm. long, subulate or setaceous; petioles 4-6 mm. long; leaves few, the basal ones 2–4 cm. long, oblong, the others 3–9 cm. or more long, oblong-lanceolate or linear, acutish at each end, coriaceous, glabrous above, the reticulated veins confluent with the conspicuous marginal nerve and minutely strigose beneath; flowers 1–16 cm. long, rose-purple, on 1–3 mm. long pedicels or 1–3, minutely pedunculate in the axils of the upper leaves; bracteoles minute, setaceous; calyx 6–7 mm. long, campanulate, strigose-hirsute, the acuminate teeth somewhat scarious-margined, the broadly ovate-lanceolate upper one minutely 2-toothed, the others more slender, the middle one the narrowest and longest; vexillum with a conspicious indentation at the apex, minutely biappendiculate at the base, abruptly tapering to the filiform claw; anthers oblong-ovoid; legume 2.5–3.5 cm. long, 4–5 mm. wide, coriaceous, acuminate, retrorsely hirsute and puberulous, with a somewhat raised suture. Mature seeds not seen.

Original locality, El Rio Quarto, west side of Las Pampas, Argentine Republic.

Type, Gillies in Herb. Arnott, fide Torrey & Gray.

Eastern Texas, Central America. Uruguay and Argentine Republic.

Synonymy: *Cologania heterophylla* Gillies; Hook. & Arn. in Hook. Bot. Misc. 3: 181. 1833.

Galactia marginalis Benth. Ann. Wien. Mus. 2: 126. 1838.

2. **Galactia erecta** (Walt).

Erect from a slender ligneous somewhat fusiform rhizome, stems often several from the same root, 2–3 dm. or more high somewhat flexuous, glabrous or nearly so, angled above; stipules 2–3 mm. long, subulate; leaves few, usually remote; petioles 2–5 cm. long, slender; leaflets 2.5–4 cm. long, often reflexed on the rhachis, oblong, oblong-linear or linear, obtuse, rarely acutish, coriaceous, glabrous, glaucous and the veins reticulated beneath, the terminal one subsessile; flowers 8–10 mm. long, purplish, 2–5 in obscurely peduncled, axillary racemes or fascicles; pedicels

1–2 mm. long; bracteoles setaceous, 1–2 mm. long; calyx turning brown, 5–6 mm. long, hirsute, scarious-margined, the lower teeth slender, acuminate, the upper one broader, minutely 2-toothed; vexillum round-ovate, retuse; legume linear-oblong, about 2 cm. long, hirsute; seeds about 6. June–August.

Original locality, "Carolinas."

Dry pine barrens, North Carolina to Florida, Alabama and Louisiana.

SYNONYMY: *Ervum erectum* Walt. Fl. Car. 187. 1788.

Glycine stricta Hook. & Arn. in Hook. Comp. Bot. Mag. 1: 22, 1835.

Galactia sessiliflora Torr. & Gray, Fl. N. Am. 1: 288; 687. 1838.

3. Galactia Grayi.

Decumbent, canescent-sericeous throughout; stems slender, several from a large, thick, ligneous root, retrorsely strigose, 3–6 dm. or more long, simple or branched; stipules minute, subulate; petioles 1–2.5 cm. long, canescent-strigose; leaflets 7–16 mm. long, oblong, sub-cuneate or nearly linear, obtuse, retuse, mucronulate or acutish, emarginate, when 5-foliolate, the terminal leaflet short petioluled, the accessory ones affixed to the lateral pair; sessile or nearly so; racemes 1–4-flowered; peduncles 1–2.5 cm. long; bracteoles minute; pedicels 5–7 mm. long; flowers 1.5–1.8 cm. long; calyx 8–10 mm. long, the teeth slender, acuminate, the slightly broader, upper one minutely 2-toothed; vexillum yellowish, oblong-ovate, retuse, acute at the base, the other petals rose-purple, the keel conspicuously longer than the narrow wings; anthers oblong; legume about 8 cm. long, 5 mm. wide, linear-oblong, acute; seeds 3–4 mm. long, oblong, apparently truncate at the ends.

Original locality, on the Llano River, Texas.

Type, Lindheimer No. 591 in Herb. Columbia College.

Texas, Llano River; San Diego (Miss Croft); Pena and Chenate Mts. (Nealley).

SYNONYMY: *Galactia heterophylla* A. Gray, Bost. Journ. Nat. Hist. 6: 171. 1850. Not *G. heterophylla* (Gillies.)

4. Galactia brachypoda Torr. & Gray, Fl. N. Am. 1: 288. 1838.

Erect, stems slender, branched, at length decumbent, somewhat puberulous, or nearly glabrous, slightly angled and channelled above, 4–6 dm. long; stipules 2–4 mm. long; leaflets 2–

35 cm. long, oblong or linear-oblong, thinnish, obtuse or emarginate, glabrous or minutely appressed-hirsute above, paler, somewhat strigose or glabrate beneath, the lateral ones very short petioluled or nearly sessile; flowering racemes usually shorter than the leaves, at length elongated; flowers rose-purple or purple, 8–10 mm. long, sessile or very short pedicelled; bracteoles minute; calyx 5 mm. long, clothed with spreading, yellowish hairs, the lower lobes acutish, the middle one somewhat the longest, the broader upper one, minutely 2-toothed; vexillum 7–8 mm. long, round-ovate, apparently not indented at the apex and paler in color than the other petals, the filiform claw 1 mm. long; anthers very small, round-oblong. Legume not seen. July–August.

Original locality, Middle Florida.

Type, Chapman in Herb. Columbia College.

Dry pine barrens, Middle Florida.

5. **Galactia Floridana** Torr & Gray, Fl. N. Am. 1 : 228. 1838.

Prostrate, the whole plant hoary-pubescent; stems 2 dm.–1 m. or more long, simple or branched, the upper part often densely and retrorsely white-tomentose; stipules 2 mm. long, setaceous; internodes usually shorter than the leaves; petioles 1–2.5 cm. long, angled; leaflets 1.5–4.5 cm. long, oval or oblong-oval, obtuse, rarely acutish, usually mucronulate, thick and coriaceous, reticulated and paler beneath, the basal ones often one-foliolate; racemes 4–9 cm. long, rarely longer than the leaves, usually many-flowered; flowers 1.2–1.5 mm. long, showy, rose-purple, approximated often the whole length of the rhachis; bracts minute, setaceous; bracteoles close to the base of the calyx; calyx 7–8 mm. long, the teeth scarious-margined, long-acuminate, the upper one entirely or obscurely 2-toothed, the middle lower one considerably longer; vexillum obovate, rounded above, acute at the base, the claw broad and flat; anthers linear-oblong, acute at each end; legume 4–5 cm. long, 4–5 mm. wide, linear, acuminate, tomentose. Mature seeds not seen. June–August.

Original locality, Tampa Bay, Florida.

Type in Herb. Columbia College. Florida..

5*a*. **Galactia Floridana microphylla** Chapm Fl. S. States, 108. 1884.

Smaller; petioles 5–8 mm. long; leaflets 1–2 cm. long, acutish or obtuse, mucronulate, the few flowers almost sessile in axillary clusters. Flowers and legumes not seen.

Original locality, Florida.

Type in Herb. Columbia College.

Florida.

5*b*. **Galactia Floridana longeracemosa** n. var.

Stouter, the leaves and racemes erect on the prostrate stems; leaflets 2.5–4.5 cm. long, 2–3 cm. wide, oval-oblong, conspicuously retuse, glabrate above, somewhat strigose-pubescent beneath; flowers 1.2–1.5 cm. long, bright rose-purple, 2–4 together at regular intervals above the middle of the rhachis; calyx becoming glabrate. Legume not seen.

Florida. J. H. Simpson. 1889.

6. **Galactia fasciculata** n. sp.

Prostrate or climbing high on bushes; stems 1-2 m. or more long, terete, clothed with a close fine retrorse-canescent tomentum; stipules minute, subulate; internodes longer than the leaves, 4–6 cm. or more; petioles 5–10 mm. long; leaflets round-oblong or sub-orbicular, 1.5–3 cm. long, 1.5–2.5 cm. broad, retuse; finely appressed silky-pubescent above, appressed silky-villous and paler beneath; racemes several, fascicled in the axils of the leaves, forming conspicuous clusters at the slightly enlarged nodes; flowers pale lilac-purple, 1.5 cm. long, solitary or two together, scattered along nearly the whole length of the somewhat flexuous rhachis; bracts minute; bracteoles 1 mm. long, subulate, acuminate, close to the base of the calyx; calyx 8 mm. long, clothed with short, white, silky hairs, the lobes acuminate, the upper one apparently entire, the middle lower one the longest; vexillum 1.5 cm. long, oblong-obovate, tapering to the base of the claw, obtuse or acutish at the apex, the wings very slender; authers linear-oblong, obtuse. Legume not seen.

Conspicuous for its roundish leaflets, and its numerous fascicled often branched and flexuous racemes.

Type, Nash, no. 2480 in Herb. Columbia College, from Tampa, Florida.

7. **Galactia canescens** (Scheele) Benth. Ann. Wien. Mus. 2: 126. 1838.

Prostrate, creeping on the ground, canescent throughout, many of the racemes becoming subterranean and bearing globular 1-seeded pods: stems several from the same slender, ligneous root, branched at the base; stipules 1–2 mm. long, subulate; internodes 1–15 cm. long; petioles 3–7 cm. long; leaflets 2–4 cm. long, 1.5–3 cm. wide, broadly ovate or oval, retuse, thick and coriaceous, slightly hirsute above, silky canescent-pubescent, much whiter and the veins reticulated beneath; peduncles slender, elongated, few-flowered; bracts and bracteoles minute, subulate;

calyx silky-hirsute, the teeth acuminate; corolla rose-purple?; vexillum obovate; subterranean pods 8 mm. long and broad, reticulated, emarginate, appressed-hirsute, the seeds 6 mm. long, 4 mm. wide, ovoid-elliptical, slightly rounded at the ends, light brown, the other pods 2–3 cm. long, 6–7 mm. wide, linear-oblong, acute, tapering to the base, densely pubescent or tomentose, the seeds elliptical-oblong, mature ones not seen.

Original locality, Texas.

Type, Lindheimer, No. 370.

Sandy ground, Texas.

SYNONYMY: *Heterocarpaea Texana* Scheele, Linnaea 21: 468. 1850.

8. **Galactia Texana** (Scheele) A. Gray, Bost. Journ. Nat. Hist. 6: 170. 1850.

Procumbent from a ligneous root; stems slender, long, conspicuously twining, retrorse-pubescent or hirsute; stipules minute, caducous; petioles 1–4 cm. long, slender; leaflets 2.5–5 cm. long, 2–3.5 cm. wide, oval, retuse, mucronulate, minutely appressed-cinereous-puberulous or glabrate above, appressed sericeous or sparingly villous beneath, thin, becoming slightly coriaceous; racemes few-flowered, much shorter than the leaves; flowers not seen; calyx 5 mm. long, the teeth attenuate; legume slightly falcate, 4–5 cm. long, 5–6 mm. wide, acute at each end, appressed-hirsute; seeds 5–7, 5 mm. long, elliptical, truncate at the ends, light brown.

Original locality, near New Braunfels, Texas.

Type, Lindheimer. Confined to Western Texas.

SYNONYMY: *Lablab Texanus* Scheele, Linnaea, 21: 467. 1848.

9. **Galactia regularis** (L.) B. S. P. Prel. Cat. N. Y. 14. 1888.

Prostrate and climbing on bushes, from a stout, ligneous root; stems 4 dm.–1 m. long or more, terete, minutely retrorse-pubescent, becoming glabrate; internodes about the length of the leaves; stipules minute, subulate; petioles 1–3 cm. long; leaflets 2–4.5 cm. long, rather rigid, elliptical-oblong, or ovate-oblong, obtuse, rarely acutish, often retuse and apiculate, emarginate, glabrous above, somewhat appressed-hirsute or pilose and lighter beneath; racemes 3–9 cm. long, usually rigid, and, with the leaves erect on the prostrate stem, the smaller accessory ones only occasional; flowers violet-purple, showy, often scattered the whole length of the rhachis; bracts small; bracteoles subulate, 1–2 mm. long; calyx 6–9 mm. long; glabrate or with a few scattered hairs, conspicuously acuminate in bud, the teeth slender, obscurely sca-

rious-margined, the upper broader one entire; vexillum obtuse or acutish, tapering to the flat claw, with an obscure, brownish spot below the middle; anthers linear-oblong, acute at each end; legume 3.5 cm. long, 4–5 mm. wide, linear, acutish at each end, appressed-hirsute, becoming glabrate; seeds about 3 mm. long, oblong-orbicular, brown. June–August.

Original locality, Virginia.

Type, in Herb. Mus. Brit.

Pine barrens and sandy woods, Southern New York to Florida and Mississippi.

SYNONYMY: *Dolichos regularis* L. Sp. Pl. 726. 1753.

Ervum volubile Walt. Fl. Car. 187. 1788.

Galactia glabella Michx. Fl. Bor. Am. 2: 62. 1803.

Galactia Purshii Desv. Ann. Sci. Nat. 9: 413. 1826.

ILLUSTRATIONS: Hill, Veg. Syst. 21: *pl. 19.* 1772.

A slender, smaller leaved form of this species has been collected at Aiken, S. C., by H. W. Ravenel.

10. * **Galactia volubilis** (L.) Britt. Mem. Torr. Club, 5: 208. 1894.

Prostrate and climbing on bushes, from a slender, ligneous root; stems 4 dm.–1 m. or more long, retrorsely and finely hirsute; stipules minute, subulate; petioles 1–5 cm. long; leaflets 2–5 cm. long, ovate-oblong or rarely lanceolate-oblong, obtuse, often retuse, mucronulate, rarely acutish, glabrous or somewhat pilose above, lighter, minutely pubescent or pilose beneath; racemes 2 or 3 cm.–2.4 dm. long, often slender and filiform; flowers 8–10 mm. long, lilac or pink-purple; bracts and bracteoles minute; calyx 6–8 mm. long, attenuate in bud, glabrate or somewhat pilose,

* This species is based on the Dillenius plate cited below and is most variable and difficult to define. The type specimen is evidently the larger leaved, long-racemed form that occurs principally from North Carolina to Florida on the coast, and has been confounded with *G. mollis* Michaux. The more northern plant has usually shorter racemes, the upper part of which often falls off before maturity of the fruit, which gives the appearance of very short, sometimes sessile racemes. It has in its more southern limits been confounded with *G. tenuiflora* (Willd.) Wight and Arn. An original type specimen of Wight Nos. 874 and 875 from Colemala, East Indian Peninsula preserved in Herb. Columbia College differs materially from the North American plant. *G. tenuiflora* occurs in South America and is referred in Index Kewensis to *G. dubia* DC. Prod. 2: 238. *Galactia Macreei*, the type specimen of which is preserved in Herb. Columbia College, is merely a very slender filiform-racemed variation.

the lobes nearly equal, slender; vexillum obovate, rounded above, biappendiculate at the base, claw slender; legume 3–5 cm. long, 4–5 mm. wide, acute at each end, linear or linear-oblong; seeds 6–9, when mature nearly as wide, truncate at each end, brown, with black markings. May–August.

Original locality, "America Septentrionali."

Long Island to Florida, west to Pennsylvania, Tennessee and Texas.

SYNONYMY: *Hedysarum volubile* L. Sp. Pl. 750. 1753.

Galactia mollis Nutt, Gen. 2: 117. 1818. Not Michaux.

Galactia pilosa Ell. Bot. S. C. & Ga. 2: 238. 1824. Not Nuttall.

Galactia Macreei M. A. Curtis, Bost Journ. Nat. Hist. 1: 120. 1837.

Galactia villosa Eat. & Wright, N. Am. Bot. 248. 1840. Not Wight & Arnott.

ILLUSTRATIONS: Dill. Elth. 173. *pl. 43. f. 170.* 1732.

Hill, Veg. Syst. 21: *pl. 43. f. 4.* 1772.

10a. **Galactia volubilis Mississippiensis** n. var.

Leaflets oval or oval-oblong, pilose on both surfaces, lighter beneath, mostly retuse; racemes slender, varying in length; flowers slightly smaller, pale lilac; legume 3–4 cm. long. Otherwise as in the type.

Missouri, Arkansas, Indian Territory and Louisiana.

An oval, pilose-leaved form that in Missouri seems very distinct, but specimens from other localities seem to intergrade with the broader leaved form of the type.

10b. **Galactia volubilis intermedia.**

Very slender; leaflets linear or linear-oblong; racemes filiform, the flowers on the upper portion often sessile in the axils of the leaves; legume 2–3 cm. long.

Florida to Louisiana.

SYNONYMY: *Galactia pilosa γ angustifolia* Torr. & Gray, Fl. N. Am. 1: 287. 1838. Not *G. angustifolia* Kunth.

A very slender form, intermediate between the type and *G. angustifolia* Kunth, or what passes as such.

11. **Galactia mollis** Michx. Fl. Bor. Am. 2: 61. 1803.

Prostrate or climbing, villous and somewhat hoary throughout; stems several from the same slender root, simple or branched; the racemes and petioles mostly erect on the decumbent stems; stipules subulate 1–2 mm. long; petioles 2, rarely 5 cm. long; leaflets 2.5–5 cm. long, oval or oblong, obtuse or emarginate at both ends, sometimes retuse, the upper ones often acutish, bright, light green, scabrous and villous above, villous and paler beneath, the young ones densely tomentose, the lateral ones usually rounded at each end, the terminal one more tapering at the base; racemes solitary 1–2 dm. or more long; flowers acute in the bud, bright red or rose-purple, short pedicelled, approximated near the summit of the short peduncle, bracts setaceous, minute, bracteoles subulate, 1.5 mm. long; calyx about 6 mm. long, densely villous, the broader upper tooth entire, nearly equalling the more slender lower ones; vexillum obovate, rounded above, tapering to the obscurely biappendiculate base, keel-petals paler in color and considerably smaller than the slender wings; legume 2.5–3.5 cm. long, 4.5–5.5 mm. wide, linear-oblong, acutish, densely tomentose; seeds ovoid, acutish, brown. July–August.

Original locality, "Carolina inferiore."

Type, in Herb. Michaux.

Dry, sandy pine lands and swamps, North Carolina to Florida.

SYNONYMY: *Galactia pilosa* Nutt. Gen. 2: 116. 1818. Not Elliott.

A very slender form of the above species with narrower leaflets, which are obscurely scabrous or glabrate above and less villous beneath, occurs in Florida.

12. **Galactia Cubensis** H. B. K. Nov. Gen. 6: 429. 1823.

Climbing high on shrubs and trees; stems terete, retrose-pubescent, becoming often nearly glabrate; stipules 2–3 mm. long, subulate; petioles 1–3 cm. long; stipels 2 mm. long, setaceous, 2 mm. long, often persistent; leaflets 2.5–8 cm. long, oblong, oblong-oval or elliptical, obtuse and emarginate at both ends, thick, rigid and coriaceous, glabrous and finely reticulated above, pubescent, paler and reticulated beneath; racemes mostly longer than the leaves, 5 cm.–1.4 dm. long; flowers 10–12 mm. long, pale purple, sessile or nearly so, solitary or two, opposite at regular intervals often the whole length of the rhachis; calyx 5–6 mm. long, the lobes attenuate, pubescent; vexillum obovate; legume 4–5 cm. long, 5–6 mm. or more wide, acutish, hirsute, at length glabrate, the conspicuous, raised sutures glabrous; seeds 6–10, 3–4 mm.

long, oblong, ovoid, brown, mottled with black. Very variable. March–December.

Original locality, near Havana, Cuba.

Keys, Florida, West Indies; also in Central America.

SYNONYMY: *Galactia spiciformis* T. & G. Fl. N. Am. 1: 287. 1838.

13. **Galactia Wrightii** A. Gray, Pl. Wright. 1: 44. 1852.

Sub-erect or decumbent; stems several from the same lignescent root, branched from the base, cinereous with a fine, white, appressed, retrose pubescence; stipules 1–2 mm. long, subulate or setaceous; petioles 1–4 cm. long; leaflets oblong or oblong-linear, 2–5 cm. long, obtuse, mucronulate, less canescent above than beneath, rarely becoming glabrate above; racemes many-flowered, 5–15 cm. long, the lower ones longer than the upper ones; flowers purplish, about 1 cm. long, sessile or nearly so, 2–3, fascicled at mostly regular intervals along the upper portion of the rhachis; calyx 5–7 mm. long, sericeous, the lobes acute, the middle lower one attenuate and longer; vexillum 7–10 mm. long, obovate, retuse, tapering to the biappendiculate base; legume 3–4 cm. long, 4 mm. wide, sericeous, acute at each end, 4–7 seeded. Mature seeds not seen. July–October.

Original locality, Hills near Limpia, Texas.

Type, Wright No. 111. 1849.

Extreme western Texas and adjacent New Mexico and Mexico.

SYNONYMY: *Galactia tephrodes* A. Gray, Pl. Wright. 2: 34. 1853.

14. **Galactia Elliottii** Nutt. Gen. 2: 117. 1818.

Prostrate and climbing high on brushes; stems branched, 1–3 m. long, from a long, branched, lignescent rhizome, angled, channelled, striate and somewhat retrorse-hirsute; stipules minute, subulate; petioles 2-5 cm. long; leaflets 2–3 cm. long, elliptical-oblong, obtuse, somewhat retuse, mucronulate, coriaceous, glabrous and shining above, pubescent beneath; racemes longer than the leaves, 1–3 dm.; flowers 10–12 mm long, white, tinged with red, 2 or 3 together, fascicled at regular intervals along the upper part of the rhachis; bracts and bracteoles minute; calyx about 7 mm. long, appressed-hirsute, the lobes slender, attenuate, vexillum obovate, obtuse or acutish, obscurely biappendiculate at the base; legume 3–4 cm. or more long, 1 cm. wide, oblong, acutish, emarginate, tomentose; seeds 3–5, about 5 mm. long, ovoid, blackish, smooth and shiny.

Original locality, South Carolina.

Dry soil and pine lands, South Carolina to Florida, near the coast.

SYNONYMY: *Galactia pinnata* Muhl. Cat. 65. 1813. Not Persoon, 1807.

Tephrosia Elliottii Benth. Ann. Mus. Wien 2: 127. 1838.

14a. **Galactia Elliotti Leavenworthii** Torr. & Gray. Fl. N. Am. 1: 687. 1838.

Silky pubescent or villous throughout.

Type in Herb. Columbia College.

Florida, Leavenworth; Lake Co., Nash.

New or noteworthy American Grasses.—III.

BY GEO. V. NASH.

EATONIA NITIDA (Spreng.).

Aira nitida Spreng. Fl. Hal. Mant. 1: 32. 1807.

Aira Pennsylvanica Spreng. Mem. Acad. St. Petersb. 2: 299. *pl.* 7. 1810.

Aira mollis Muhl. Gram. 82. 1817.

Eatonia Dudleyi Vasey, Coult. Bot. Gaz. 11: 116. 1886.

Sprengel in his description of *Aira nitida* describes the leaves as 1′ long and pubescent at the base. These are characters which are peculiar to the plant known as *Eatonia Dudleyi* Vasey, which is very common in Pennsylvania, the region from which Sprengel's plant came. The *Aira Pennsylvanica* Spreng. is certainly the *Eatonia Dudleyi* Vasey. The figure cited above well represents this species.

The more prominent characters which appear to separate this plant from the *Eatonia Pennsylvanica* (DC.) A. Gray, are: The almost constant pubescence of the sheaths, at least the lower ones; the slender culm; the short, often pubescent leaves; and the broader first scale, which is about one-third the width of the second.

PUCCINELLIA AIROIDES (Nutt.) Wats. & Coult. in A. Gray, Man. Ed. 6, 668. 1890.

Poa airoides Nutt. Gen. 1: 68. 1818.

Glyceria distans var. *airoides* Vasey, Cat. Grasses U. S. 87. 1885.

Panicularia distans airoides Scribn. Mem. Torr. Club, 5: 54. 1894.

This plant appears to be specifically distinct from the *P. distans* Parl. The taller and more slender culms, the panicle-branches dividing nearer the extremities, the fewer and less crowded spikelets, and the comparative length of the empty and flowering scales serve well to distinguish it. In *P. distans*, a coast plant, the second empty scale is less than one-half as long as the flowering ones; while in *P. airoides*, a plant of the western interior, it exceeds one-half the length of the flowering scales.

PUCCINELLIA ANGUSTATA (R. Br.).

Poa augustata R. Br. App. Parry's Voy. 287. 1824.

Glyceria angustata Fries, Mant. 3: 176. 1842.

Panicularia angustata Scribn. Mem. Torr. Club, 5: 54. 1894.

BROMUS PORTERI (Coulter).

Bromus Kalmii var. *Porteri* Coulter, Man. Rocky Mt. Region, 425. 1885.

Culms 1½°–3° tall, erect, simple, pubescent below the nodes. Sheaths shorter than the internodes, glabrous or sometimes softly pubescent; ligule ½″ long, truncate; leaves 1″–3″ wide, rough, those of the culm 4′–9′ long, the basal narrow and about one-half of the length of the culm; panicle 3′–6′ in length, its branches drooping and flexuous, at least when old, the nodes of the axis pubescent; spikelets 5–10-flowered, 9″–15″ long, on slender flexuous pedicels; empty scales pubescent, the first narrower than the second, both 3-nerved; flowering scales 5″–6″ long, obtuse, 5–7 nerved, densely pubescent with long silky hairs; awn 1″–2″ long.

In dry soil, South Dakota to Montana, south to western Nebraska, New Mexico and Arizona.

This plant is readily distinguished from *B. Kalmii* by its 3-nerved second scale and longer flowering scales. In *B. Kalmii* the second scale is 5–7–nerved and the flowering scale about 4″ long.

Notes on Some Southern Cassias.

By Charles Louis Pollard.

(Plates 250–252.)

The Chamaecristoid Cassias have always been recognized as a group of great perplexity within a genus of otherwise clear delimitations. Even Bentham, whose careful monographic work is still our standard authority on this genus, admits that his treatment of the Chamaecristae verae is far from satisfactory.* The difficulty is due to the close relationship which the species exhibit, and to the consequent fact that specific distinctions throughout the group are hardly obvious in a superficial examination. I am convinced, however, that differences in the periods of flowering and fruiting, as well as in geographical range, will afford characters by which our American species may be satisfactorily separated. The recent collections of Messrs. A. H. Curtiss and G. V. Nash, in Florida, have contributed much toward a clearer comprehension of this essentially Southern group.

The Chamaecristae verae fall naturally into two divisions: those with small or minute, and those with relatively large flowers; and the general tendency among American botanists has been to refer all plants belonging to the first division to *C. nictitans*, while all large-flowering forms were unhesitatingly classed with *C. Chamaecrista*. Muhlenberg was probably the first to recognize that the South contained more than two species and he accordingly named the hirsute plant which grows in dry fields in Florida *Cassia aspera*.† This was reduced by Torrey and Gray‡, but has been quite generally recognized in recent years as a perfectly valid species. Twenty years before this Michaux had described what he took to be a new Cassia, under the name of *C. fasciculata;*‖ but this was referred by Bentham, who had access to Michaux's type in Paris, to *C. Chamaecrista*, and it probably belongs there.

After a critical study of numerous specimens I have reached the conclusion that the true *C. nictitans* of the North does not extend into Florida; a theory that seems to be confirmed by numerous field observations kindly communicated to me by Mr.

*Trans. Linn. Soc. London, 27: 536. 1871. †Ell. Bot. S. Car. & Georg. 1: 474. 1821. ‡Torr & Gray. Fl. N. Am. 396. 1838. ‖Fl. Bor. Am. 1: 262. 1803.

Nash. It is replaced by *C. aspera*, a plant of dry barren fields and by a multipinnate, rather tall growing plant, hitherto unnamed, distributed as *nictitans*, but certainly not referable to that species.

C. Chamaecrista grows in Florida, assuming an erect, bushy habit, and often attains a height of from two to three feet. It is associated with another undescribed species, of low growth and divaricately much branched. The technical distinctions between these two new species will be discussed in the subjoined descriptions; but the differences shown in the flowering period are worthy of special note.

Cassia nicticans flowers in August throughout the North and somewhat earlier south of the Virginia line. Its Florida congener is barely in flower by the middle of August, while flowering specimens collected by Mr. Curtiss bear date of September 15, at which time *nictitans* has withered foliage and thoroughly mature pods. *C. Chamaecrista* flowers from May 1 to 15, in Florida, and throughout June at the North; the new allied species was collected by Mr. Nash on September 5, with no pods as yet formed.

These data are remarkable and quite conclusive. It is natural to find a plant of northern range blooming a week or even a month *earlier* in a more southerly latitude; but it is not to be supposed that a plant whose flowering period extends through May and June should assume an autumnal form in the South, especially when we bear in mind the fact that all these Cassias are annuals, and hence can bloom normally but once in a season. It is of course barely possible that *C. Chamaecrista* ripens its fruit in June and presents well developed plants two or three feet in height in late August; in case careful field observations should prove this to be a fact, we shall have a most remarkable case of dimorphism in a single species.

The following key presents the salient characters of the Chamaecristae verae in North America. *C. cinerea* Cham. and Schlecht., a species of Texano-Mexican distribution simulates this group, but belongs in the series Dimidiatae.

KEY TO THE SPECIES.

Flowers large (exceeding 1 cm.).
Leaves glabrous.
Plants tall, erect. *C. Chamaecrista.*
Plant low, diffusely branched. *C. depressa.*

Leaves pubescent.	
Leaflets linear falcate, appressed.	*C. procumbens.*
Leaflets elliptical, spreading.	*C. mississippiensis.*
Flowers small (not exceeding ¼ cm.).	
Plants strongly hirsute.	
Leaves 8–12-foliolate.	*C. simpsoni.*
Leaves 20–24-foliolate.	*C. aspera.*
Plants glabrate or pubescent.	
Leaflets narrow, 20–25.	*C. multipinnata.*
Leaflets broad, 8–14.	*C. nictitans.*

CASSIA MULTIPINNATA n. sp.

Slender, tall, erect, more or less branched; stem slightly woody at base, pubescent; leaves lanceolate-elliptical in outline, 20–25-foliolate, the rhachis obscurely strigose-pubescent; leaflets 10 mm. long, 1½ mm. wide, glabrous, narrowly linear, cuspidate, the midvein approximating the outer margin; petiolar gland minute, depressed-cupuliform, substipitate; stipules long-acuminate, striate, foliaceous; flowers scattered, sessile, the corolla quite irregular, its small yellow petals not much exceeding the narrow, scarious-edged sepals; legume linear, compressed, pubescent or even hirsute, dorsally and ventrally dehiscent, elastic, 2 to 2½ cm. long seeds 4 to 6, oblique. (Plate 250.)

Near Jacksonville. A. H. Curtiss, North American Plants. No. 512, distributed as *C nictitans* and *C. nictitans* var. *aspera;* second distribution, No. 5157, September 15, and October 27, 1894. Tallahassee. G. V. Nash, No. 2403, August 12, 1895.

This is separable from *nictitans* by the narrowly linear, very numerous leaflets, the more hairy pod, and the late period of flowering. The irregular corolla, noticeable in some other members of this group of Cassia, but not often commented on, is here very prominent, one petal greatly exceeding the others.

CASSIA MULTIPINNATA NASHII n. var.

Differs from the erect type in being of low, diffusely spreading habit.

Collected in low pine woods, River Junction, Gadsden Co., Florida, by Mr. Nash, September 5, 1895 (no. 2577).

CASSIA DEPRESSA n. sp.

Low and spreading, but not prostrate, divaricately much

branched; stems obscurely strigose-pubescent; leaflets 6 to 10 pairs, linear-elliptical, glabrous, 9 mm. long, 2 to 3 mm. broad, with the excentric midrib of *C. Chamaecrista;* petiolar gland small, circular, sessile, depressed; flowers solitary on filiform mostly supra-axillary peduncles; petals large, obovate, much exceeding the sepals, 1½ cm. long, 1½ cm. broad; sepals linear, scarious, strongly ciliate; legume not observed. (Plate 251.)

Low pine woods, River Junction, Gadsden Co., Florida. G. V. Nash, September 5, 1895 (no. 2571).

Potosi, Missouri. F. Pech.

The difference between this and *C. Chamaecrista* lies mainly in its aspect, but the leaflets are smaller and less numerous and the flowers are relatively much larger. The flowering period, moreover, is from two to three months later than in that species.

Cassia Mississippiensis Pollard, Bull. Torr. Club, 21: 219. 1894.

This plant has not yet been collected, so far as I am aware, outside of the State from which it was first described. Professor S. M. Tracy, of the Mississippi Agricultural Experiment Station, wrote me that he had four acres covered with a dense growth of the species; from which I infer that it is locally as troublesome a weed as *C. nictitans.*

Cassia Simpsoni Pollard, Bull. Torr. Club, 21: 221. 1894.

Apparently a subtropical type, confined in the United States to the Keys of Florida, but probably growing in Cuba. It may be considered, in fact, the West Indian representative of the Texano-Mexican species *C. procumbens* L. The original specimens, collected by Mr. J. H. Simpson, on No Name Key, are in the possession of the National Herbarium. I have detected it in no other collection thus far examined.

Explanation of Plate 252.

Fig. 1. Cassia nictitans L.
Fig. 2. Cassia aspera Muhl.
Fig. 3. Cassia multipinnata Pollard, n. sp.
Fig. 4. Cassia Simpsoni Pollard.
Fig. 5. Cassia Chamaecrista L.
Fig. 6. Cassia depressa Pollard, n. sp.
Fig. 7. Cassia Mississippiensis Pollard.
Fig. 8. Cassia procumbens L.

Calamagrostis scopulorum Jones.*

Last spring, when Mr. Jones was engaged in naming his collection of Utah plants at the National Herbarium, his specimens of *Calamagrostis* were submitted to me for determination, as I am engaged in revising the North American species of that genus. I mentioned to Mr. Jones that the species in question was doubtless an undescribed one, and requested that the specimens be left with me for further study. Mr. Jones told me that he would have to take the specimens away then to catalogue them, but gave me the impression that I should have an opportunity to examine them later on. Since then I have not seen them, and specimens of this, as well as of Mr. Jones' two other new species of grasses, appear to be missing from the set deposited in the National Herbarium. I think it well to call attention to this as an instance of a species of discourtesy (to use no harsher word) too often suffered by students of special groups.

Calamagrostis scopulorum is a perfectly distinct species of rather perplexing relationship. It is *not* closely allied to *C. sylvatica*, being distinguished from all species of that group by its slender, straight awn not exceeding the flowering-glume. In its spikelets it resembles *C. Aleutica*, but is widely different in its vegetative organs, habit and appearance. At first glance it appears very close to *C. Cusickii*, but is readily distinguished by the shorter and more delicate awn and longer callus-hairs. The same species was collected by Mr. Jones at Alta, Utah, in 1879 (no. 1145). Some expressions used in the description are rather peculiar, such as "spikelets appressed," "outer" and "inner *rays*" of the panicle, lower empty glume and palet "simply acute," etc. It is not usual, in describing grasses, to mention the characters of the palet before describing the flowering-glume.

In passing, it may be worth while to mention that, as Lamarck published a *Poa festucoides*, that name is not available for Mr. Jones' species, for botanists of every school have practically agreed that, from now on, at any rate, the law of homonyms shall be observed, even if it be not made retroactive. An *Elymus* with the

* M. E. Jones, Contributions to Western Botany; Proc. Calif. Acad. (II.) 5: 722 1895.

"habit of *Sporobolus airoides*, but culms very different;" "spikelets single at each joint;" "loose spike like *Agropyrum glaucum*, which it much resembles;" and "most of the technical characters of *Hystrix*, but manifestly allied to *Elymus condensatus* and may prove to be only a form of it," may well be called a "remarkable plant." T. H. KEARNEY, JR.

Proceedings of the Club.

WEDNESDAY EVENING, NOV. 27, 1985.

The President occupied the chair and there were about 50 persons present. Benjamin Heritage and Jos. A. Hays were elected active members.

The announced paper of the evening was then read by Dr. Rusby, entitled, "The Poisonous Plants of the Vicinity of New York," illustrated by lantern slides, mostly colored, and loaned by Mr. Van Brunt for the occasion. The paper was discussed by the President and Messrs. Small, Barnhart, Stewart and others. It is printed in full in the "Alumni Journal of the New York College of Pharmacy," December, 1895.

WEDNESDAY EVENING, DEC. 11, 1895.

Vice-President Lighthipe in the chair, and 52 persons present.

The Secretary called attention to the necessity for a new supply of copies of the Constitution and By-Laws and suggested that a revision of this publication be made, to include a short history of the Club. He referred also to the need of other stationery to facilitate the work of the officers of the Club, and offered a resolution that a committee to consist of the Editor, the Treasurer and the Secretary be appointed with the power to prepare a revised edition of the Constitution and By-Laws and such other stationery as is required. The resolution was unanimously adopted.

A communication from Mr. Wm. H. McDonald, of 2297 First avenue, was read, tendering a number of seeds for use in the nursery of the New York Botanical Garden.

The announced lecture of the evening, by Dr. Smith Ely Jelliffe, entitled, "Common Edible and Poisonous Fungi," illustrated by colored lantern slides, was then delivered.

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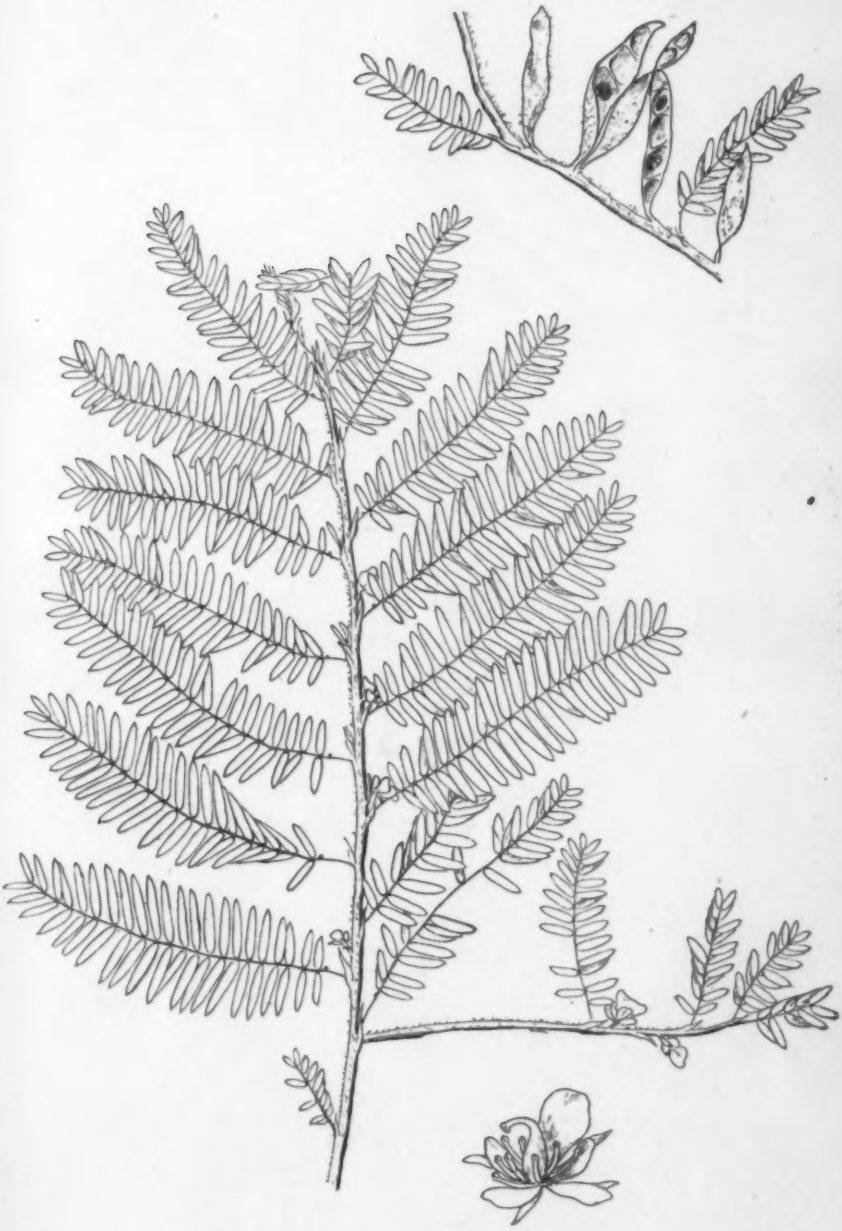
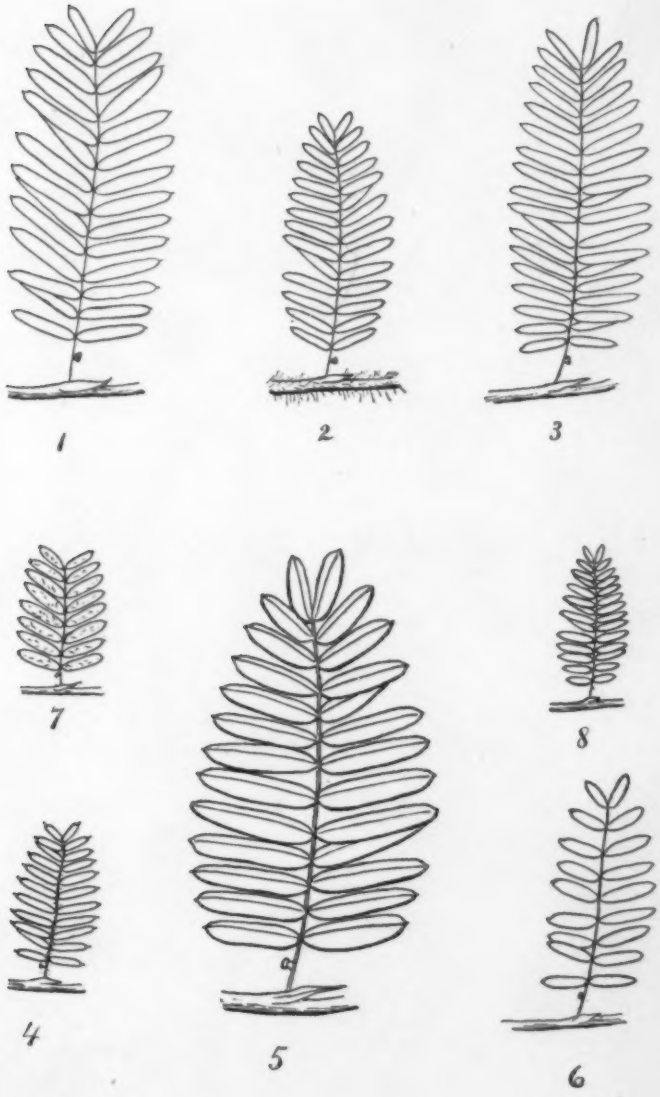


CASSIA MULTIPINNATA POLLARD.

CASSIA DEPRESSA POLLARD.



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